

Original Article

## Comparison Between Supraclavicular And Infraclavicular Subclavian Catheterization Using Ultrasound Guidance

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### ABSTRACT:

Modern critical care patients have central venous catheterization. therapeutically obtrusive. Central venous catheterization has several methods. Jugular or femoral catheterization had a higher risk of bloodstream infection and symptomatic thrombosis than 4-8 subclavian-vein catheterization. This research compares the traditional infraclavicular subclavian approach to the supraclavicular technique for simplicity of subclavian cannulation under ultrasound guidance, as well as duration, complications, success rate, and number of tries. Materials and methods: Patients who needed critical care after elective surgery arrived. received 140-sample (70 in each group). After applying exclusion criteria—coagulopathies, anticoagulants, distorted chest architecture, chest trauma, cervical rib, superior vena cava syndrome, cannulation site infection—140 patients were separated into two groups. Pregnant patients, Infected patients, Retroviral, infective endocarditis, and immunosuppressed patients Other subclavian vein cannulation within 4 days was eliminated. Discussion: The supra clavicular and infra clavicular groups had similar pre-operative systolic and diastolic blood pressure ( $121.7 \pm 6.7$  vs  $122.6 \pm 7.0$ ). Pre-operative pulse rate and pre-spo<sub>2</sub> (mean  $\pm$  SD) showed reduced variance across groups. The supra clavicular and infra clavicular groups had similar post-operative systolic and pre-diastolic blood pressure (mean  $\pm$  SD) ( $122.0 \pm 6.3$  vs  $123.5 \pm 6.0$ ). Post-operative pulse rate and Spo<sub>2</sub> were similar across groups. Both procedures were hemodynamically stable. Comparative observational research on the invasive procedure adds internal validity, and standard technique and adequate recommendations were used, therefore no issues were recorded. A larger hospital-based investigation may be needed to generalize the findings. This inquiry was unblinded. The interviewer-administered data gathering method may also create social desirability bias. Conclusion: The supraclavicular approach to the subclavian vein speeds up vein visualization, venous puncture, and catheterization, reducing treatment time. Even though the Infraclavicular technique requires more labor, both procedures had identical success rates and mechanical difficulties. Thus, the supraclavicular approach to the subclavian vein for ultrasound-guided central venous catheter insertion benefits intensive care unit and operating room patients.

### INTRODUCTION:

Modern-day critically sick patients in operating rooms and intensive care units undergo central venous catheterization. because it is therapeutic and intrusive<sup>1</sup>. Central venous catheterization has several methods. The subclavian vein is usually approached infra clavicular, However some studies suggest that the supraclavicular route offers benefits. Central venous access by supraclavicular approach to subclavian vein is safe and successful<sup>2</sup>. Ultrasound-guided central venous access yields fewer needle punctures and fewer complications than landmark approach. Deep subclavian veins return oxygen-poor blood from the upper body to the heart. We have two subclavian veins<sup>3,4</sup>. Right subclavian vein carries right upper body blood. Left upper body blood flows via left subclavian vein. Stanley E. Dudrick (1967) invented indwelling central venous catheterization for a youngster with short gut syndrome. James Broviac (1973) introduced the

first single-lumen central venous catheter for parenteral support. Ultrasound catheterization success rates were high in supraclavicular studies<sup>5-7</sup>. Hyperosmotic or vasoactive chemicals, parenteral feeding, fast infusion of large amounts of fluid, or continuous or intermittent biochemical or physiological monitoring may need central circulation access. When peripheral lines cannot be inserted, central venous catheters are used. Traditional landmark central venous catheter insertions have been done. Central venous catheterization often uses the internal jugular, subclavian, and femoral veins. Central venous catheter insertion utilizing the landmark approach had a 12.3% complication risk even with experienced operators. Central venous catheters are implanted daily, which might lead to several issues<sup>8-10</sup>. Quality improvement initiatives should routinely reduce problems. Ultrasonography for central venous catheter insertion is gaining acceptance. Ultrasonography guidelines for central venous catheter insertion is suggested by the US Agency for Healthcare Research and Quality and UK NICE to enhance patient care<sup>11-13</sup>. Ultrasonography guidance for central venous catheter insertion is still seldom employed in Western nations, despite these guidelines. Indian speciality care and portable ultrasonography devices have made bedside ultrasonography feasible in many hospitals. Previous studies showed that 4-8 subclavian-vein catheterization had a greater incidence of pneumothorax and a lower risk of bloodstream infection and symptomatic thrombosis than jugular or femoral catheterization. so this study is to compare standard Infraclavicular subclavian approach to supraclavicular approach for ease of subclavian cannulation under ultrasound guidance and also compare the approach in term of Duration of the procedure , Complications during procedure , Rate of successful cannulation ,Number of attempts to complete the procedure .

## MATERIALS AND METHODS:

Prospective A comparative research was intended to be conducted on patients who were being treated in the Main OT complex and the ICU at Velammal Medical College Hospital. The research was carried out over the course of one year, beginning in March 2021 and ending in February 2022. Clearance was granted when the protocol was written, presented to the Research and Ethics committee, and given the reference number VMCIEC/06/2021 by the committee. The period of time between March 2021 and February 2022 was used for the collecting of data. The process of analysing the data and preparing the report took place between March and August of 2022. Patients who came in for elective surgery and will need post-operative care in the intensive care unit came in. received Sample size 140 (70 in each group). One hundred and forty patients were divided into two groups after applying exclusion criteria - Those patients who were having coagulopathies, Patient on anticoagulants, Distorted chest anatomy , Chest trauma, Cervical rib , Superior vena cava syndrome, Infection at the cannulation site, Pregnant patients, Patients with obvious source of infection , Patients having infective endocarditis, Retroviral disease and on immunosuppressive drugs , Recent (less than 4 days) subclavian vein cannulation for any other reason were excluded .

### Variables:

- Success rate
- Time taken for venous visualization, venous puncture and catheterization
- Total procedure duration
- Incidence of mechanical complications were variables used for comparison
- among groups.

## RESULTS:

**Table 1:** Distribution of study participant's age according mean and standard deviation between two groups:

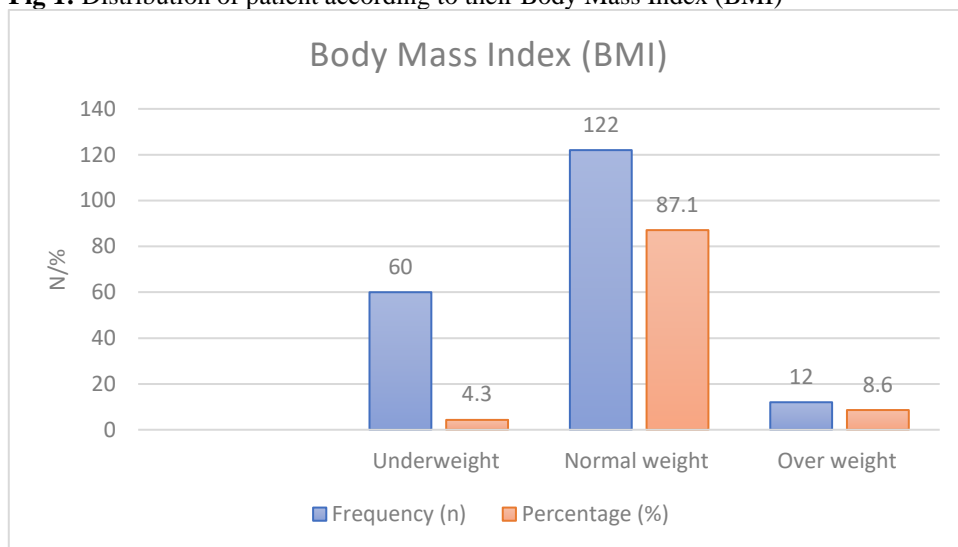
Demographic parameters	(n)	Supra clavicular		Infra clavicular		p-value
		Mean	Std. Deviation	Mean	Std. Deviation	
Age	70	44.34	11.407	44.34	11.407	0.731

**Table 2:** Distribution of study participants based on the gender between two groups

Gender	Supra clavicular	Infra clavicular	p-value
	Frequency (n) & percentage (%)	Frequency (n) & percentage (%)	
Male	43 (61.4%)	36 (51.4%)	0.233
Female	27 (38.6%)	34 (48.6%)	
Total	70 (100%)	70 (100%)	

In this study, the distribution of study participants based on gender between two groups were, in supra clavicular the male were 43 (61.4%) and female were 27 (38.6%), in second group infraclavicular the male were 36 (51.4%) and female were 34 (48.6%). The statistical association were done between two groups and found to be not significant with the p-value of 0.233 shown in table 1 and 2.

**Fig 1:** Distribution of patient according to their Body Mass Index (BMI)



The distribution of study participants based on their BMI, patient with normal weight were found to be 122 (87.1%), overweight were 12 (8.6%) and only 4.3% of the study participants falls underweight shown fig 1.

**Table 4:** Different times of procedure between the supra clavicular and infra clavicular group.

Time	Supra clavicular			Infra clavicular			p-value
	Median	Range	Mean± SD	Median	Range	Mean± SD	
<b>Total procedure</b>	193.0	24	192.6± 5.1	205.0	42	205.8 ± 7.7	0.000
<b>Venus visualization</b>	16.0	6	16.6± 1.9	22.0	9	22.6 ± 2.2	0.000
<b>Venus Puncture</b>	45.0	14	44.6 ± 4.1	49.0	24	48.4 ± 5.0	0.003
<b>Venus Puncture</b>	131.0	16	131.3 ± 3.6	135.5	26	134.8 ± 5.0	0.015

Total procedural time (mean ± SD) was lesser in supra clavicular group than Infra- clavicular group (192.6 ± 5.1 vs 205.8 ± 7.7seconds with 95% CI) and the difference was statically significant with p-value of 0.000. Similarly venus visualization, venus puncture and venous catheterization of (mean ± SD) were less in supra clavicular than infra clavicular group and shows statistically significant shown in table 4.

**Table 5:** Distribution of study participants based on the monitoring of Pre and post- operative systolic blood pressure:

Catheterization type		Presystolic BP	Post systolic BP	p-value
<b>Supra clavicular</b>	Frequency (n)	70	70	
	Mean	121.70	122.06	
	Median	122.00	122.00	
	Std. Deviation	6.742	6.395	
	Range	24	24	
<b>Infra clavicular</b>	Frequency (n)	70	70	
	Mean	122.63	123.51	
	Median	122.00	123.00	
	Std. Deviation	7.041	6.093	
	Range	32	29	

The above table depict, the pre and post-operative systolic blood pressure (mean ± SD) between the supra clavicular and infra clavicular group (121.7 ± 6.7 vs 122.6 ± 6.3), (122.6 ± 6.7 vs 123.5 ± 6.0) and it shows statistical significant between the group with p-value of (<0.05), shown in table 5.

**Table 6:** Distribution of study participants based on the monitoring of Pre and post- operative diastolic blood pressure:

Catheterization type		Pre diastolic BP	Post diastolic BP	p-value
<b>Supra clavicular</b>	Frequency (n)	70	70	
	Mean	76.19	75.11	
	Median	75.50	74.00	
	Std. Deviation	4.196	4.289	
	Range	16	18	
<b>Infra clavicular</b>	Frequency (n)	70	70	

	Mean	76.74	75.93	
	Median	76.00	75.50	
	Std. Deviation	4.373	4.620	
	Range	17	19	

The above table shows, the pre and post-operative diastolic blood pressure (mean  $\pm$  SD) between the supra clavicular and infra clavicular group ( $76.1 \pm 4.1$  vs  $75.1 \pm 4.2$ ), ( $76.7 \pm 4.3$  vs  $75.9 \pm 4.6$ ) and it shows statistical significant between the group with p-value of ( $<0.05$ ) shown in table 6.

**Table 7:** Distribution of study participants based on the monitoring of pre-operative pulse rate:

Catheterization type		Pre pulse rate	Post pulse rate	p-value
Supra clavicular	Frequency (n)	70	70	
	Mean	75.43	75.40	
	Median	76.00	76.00	
	Std. Deviation	6.054	6.037	
	Range	22	22	
Infra clavicular	Frequency (n)	70	70	
	Mean	74.91	74.91	
	Median	76.00	76.00	
	Std. Deviation	5.885	5.885	
	Range	22	22	

The above table depict, the pre and post-operative pulse rate (mean  $\pm$  SD) between the supra clavicular and infra clavicular group ( $75.43 \pm 6.05$  vs  $75.40 \pm 6.03$ ), ( $74.91 \pm 5.8$  vs  $74.91 \pm 5.8$ ) and found to be statistically association between the group with p-value of ( $<0.05$ ), shown in table 7

## DISCUSSION

The rationale for the study is to test the hypothesis to check whether the efficacy of the supraclavicular approach to subclavian vein catheterization is an easy way and less time is taken when compared to the infraclavicular subclavian approach.

Key Findings of the study: Sociodemographic profile of the participants:

The mean age group of the participants are  $44.34 \pm 11.4$ . The participants were equally divided in two group 50% underwent infraclavicular approach and rest 50% supraclavicular approach were used, which is in concordance with study conducted by Thakur A et al<sup>14</sup> In supra clavicular approach male were 43 (61.4%) and female were 38.6% whereas in the infraclavicular approach 51.4% were male and 48.6% were females. The statistical association were done between two groups and was not statistically significant with the p-value of 0.233. As we can see majority were males belonging to the working age group which is a point of concern as comorbid conditions are rise in early age which is leading to further complication requiring intensive care approach in need of emergency invasive techniques.

Comparison of the time of procedure between the supra clavicular and infra clavicular approach Total procedural time was lesser in supra clavicular group than infra clavicular group ( $192.6 \pm 5.1$  vs  $205.8 \pm 7.7$ seconds with 95% CI) and the difference was statically significant with p-value of 0.000. Similarly venous visualization, venous puncture and venous catheterization of (mean  $\pm$  SD) were less in supra clavicular than infra clavicular group and shows statistically significant. Hence supraclavicular approach proved to be superior as it takes less time which also requires less anaesthesia. This is in concordance with a study conducted by Byon HJ et al<sup>15</sup> where the median puncture time was longer in the Infraclavicular group than the Supraclavicular group (48 vs 36 s, P=0.02), similar findings were noted in study conducted by Thakur A et al where the time taken for Subclavian vein catheterisation was far less in Supraclavicular approach ( $4.30 \pm 1.02$  min) and was statistically significant when compared to Infraclavicular approach ( $6.07 \pm 2.149$  min). various evidence are in supportive of Supraclavicular approach: the study conducted by Stachura MR et al<sup>16</sup> have found Supraclavicular approach allows for a better view of the Subclavian vein on ultrasound than the Infraclavicular approach, study conducted by Souadka A et al<sup>17</sup> have found supra- clavicular landmarks approach is linked to higher success rates and less arterial punctures, thereby proving to be a safe and reliable approach and study conducted by Czarnik T et al<sup>18</sup> have found Subclavian venous catheterization via the Supraclavicular approach is an excellent method of central venous access in mechanically ventilated patients.

### Comparison of the vitals between the supra clavicular and infra clavicular approach:

The pre-operative systolic and pre diastolic blood pressure between the supra clavicular and infra clavicular group shows there is no much gross differences between the groups ( $121.7 \pm 6.7$  vs  $122.6 \pm 7.0$ ). Similarly, the pre-operative

pulse rate and pre spo<sub>2</sub> (mean ± SD) found to be less variations between the groups. The post-operative systolic and pre diastolic blood pressure (mean ± SD) between the supra clavicular and infra clavicular group shows there is less differences in the mean value between the groups (122.0 ± 6.3 vs 123.5 ± 6.0). And post- operative pulse rate and post Spo<sub>2</sub> found to be very less variations between the groups. In both the procedure the patients were hemodynamically stable. Many medical societies and government organisations<sup>19</sup>, including the Society of Cardiovascular Anesthesiologists, the American Society of Echocardiography, the National Institute for Health and Clinical Excellence in the UK, the Agency for Healthcare Research and Quality, have recommended the use of ultrasound for central venous catheterization<sup>21</sup>. Despite these recommendations, the use of ultrasound for central venous catheterization remains low in resource-poor settings<sup>22</sup>.

Apart from that various studies have also proved the occurrence of technical complications, like failure attempts which might be due to poor experience which provokes the need for proper training of the physician other complication reported are complications such as pneumothorax, haemothorax, subclavian artery puncture and haematoma at the puncture site. Catheter embolisation, subsequent adverse events occur frequently following embolisation and include arrhythmias, venous thrombosis, endocarditis, myocardial perforation and pulmonary embolus are known complication associated with subclavian venous catheterisation<sup>22</sup>.

**Strength and limitations:** Comparative observational study on the invasive technique adds internal validity to the study and standard technique and proper guidelines were incorporated in the study hence no complications were reported. Since it is a hospital-based study involving a smaller sample size the results cannot be generalized hence a study with a significantly higher sample size may be required. In this investigation, the investigator was not blinded. In addition, due to the interviewer-administered nature of the data collection process, there might be a possibility of social desirability bias being introduced in this study.

#### CONCLUSION:

The results of the study imply that the supraclavicular approach to the subclavian vein shortens the duration of the treatment by speeding up the vein visualisation, venous puncture, and catheterization. Both methods showed a similar success rate and incidence of mechanical issues, even though the Infraclavicular approach may require more work. Therefore, the supraclavicular approach to the subclavian vein for ultrasound-guided central venous catheter placement is a helpful for patients in Intensive care unit and operation theatre.

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